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GoddardView

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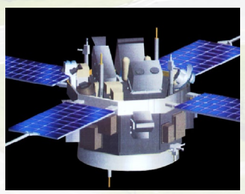
THE WEEKLY

RBSP Launches Successfully
NASA's Radiation Belt Storm Probes mission is underway following a successful launch on Aug. 30. The probes were released from the rocket's Centaur upper stage one at a time and sent off into different orbits, kicking off the two-year mission to study Earth's radiation belts. Click the image for more about RBSP.

Asteroid Naming Contest for Students
Students have an opportunity to name an asteroid from which an upcoming NASA mission will return the first samples to Earth. "It is possible the person who names the asteroid will grow up to study the regolith we return to Earth," said Jason Dworkin, OSIRIS-REx project scientist at Goddard. For rules and to enter, click on the image.



ACE Turns 15
In its first 15 years, the Advanced Composition Explorer (ACE) has helped determine the composition of the vast sea of flowing particles surrounding Earth. ACE is a crucial component of NASA's fleet, but its job as sentinel is just a small piece of what ACE has accomplished since it launched on August 25, 1997. Click on the image to learn more.

Discover Life@Goddard
Life@Goddard is the hub for the stories that make up the human side of Goddard. Connect to interviews about how Goddard people support Goddard's mission and stories about the fascinating activities our colleagues engage in outside the gates. Click on the image to explore Life@Goddard.

Cover caption: Dr. Robert Weems, emeritus paleontologist for the USGS, verifies the recently discovered dinosaur track found on the Goddard campus.

Photo Credit: NASA/Goddard/Rebecca Roth

GoddardView Info

Goddard View is an official publication of NASA's Goddard Space Flight Center. *Goddard View* showcases people and achievements in the Goddard community that support Goddard's mission to explore, discover, and understand our dynamic universe. *Goddard View* is published weekly by the Office of Communications.

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THE WEBB TELESCOPE'S GOLDEN SPIDER

By: Laura Betz

What looks like a giant golden spider weaving a web of cables and cords is actually ground support equipment, including the Optical Telescope Simulator (OSIM), for the James Webb Space Telescope. OSIM's job is to generate a beam of light just like the one that the real telescope optics will feed into the actual flight instruments. Because the real flight instruments will be used to test the real flight telescope, their alignment and performance first have to be verified by using the OSIM. Engineers are thoroughly checking out OSIM now in preparation for using it to test the flight science instruments later.

Engineers have blanketed the structure of the OSIM with special insulating material to help control its temperature while it goes into the deep freeze testing that mimics the chill of space that Webb will ultimately experience in its operational orbit over one million miles from Earth. The golden-colored thermal blankets are made of aluminized Kapton®, a polymer film that remains stable over a wide range of temperatures. The structure that looks like a silver and black cube underneath the "spider" is a set of cold panels that surround OSIM's optics.

During testing, OSIM's temperature will drop to 100° Kelvin (-280° F or -173° C) as liquid nitrogen flows through tubes welded to the chamber walls and through tubes along the silver panels surrounding OSIM's optics. These cold panels will keep the OSIM optics very cold, but the parts covered by the aluminized Kapton® blankets will stay warm.

"Some blankets have silver facing out and gold facing in, or inverted, or silver on both sides, etc.," says Erin Wilson, a Goddard engineer. "Depending on which side of the blanket your hardware is looking at, the blankets can help it get colder or stay warmer, in an environmental test."

Another reason for thermal blankets is to shield the cold OSIM optics from unwanted stray infrared light. When OSIM is pointing its calibrated light beam at Webb's science instruments, engineers don't want any stray infrared light, such as "warm photons" from warm structures, leaking into the instruments' field of view. Too much of this stray light would raise the background too much for the instruments to "see" light from OSIM—it would be like trying to photograph a lightning bug flying in front of car headlights.

To get OSIM's optics cold, the inside of the chamber has to get cold, and to do that, all the air has to be pumped out to create a vacuum. Then liquid nitrogen has to be run though the plumbing along the inner walls of the chamber. Wilson notes that's why the blankets have to have vents in them: "That way, the air between all the layers can be evacuated as the chamber pressure drops, otherwise the blankets could pop," says Wilson.

The most powerful space telescope ever built, Webb is the successor to NASA's Hubble Space Telescope. Webb's four instruments will reveal how the universe evolved from the Big Bang to the formation of our solar system. Webb is a joint project of NASA, the European Space Agency, and the Canadian Space Agency. ■

Above: Ground support equipment, including the Optical Telescope Simulator, inside the Space Environment Simulator at Goddard. Credit: NASA/Goddard/Chris Gunn

> “The second track, overlapping the first, looks to be a young version of the same creature...”

NODOSAUR FOOTPRINTS FOUND AT GODDARD

By: Karl B. Hille

About 110 million light years away, the bright, barred spiral galaxy NGC 3259 was just forming stars in dark bands of dust and gas. Here on the part of Earth where Goddard would eventually be built, not one but two plant-eating dinosaurs sensed predators nearby and quickened their pace, leaving a deep imprint in the Cretaceous mud.

The second track, overlapping the first, looks to be a young version of the same creature, perhaps following and sniffing along after, said Rob Weems, emeritus paleontologist and stratigrapher with the USGS, from Reston, Va. “It’s definitely a track.”

He confirmed the track to be a nodosaur footprint while visiting NASA Goddard on Aug. 23 at the invitation of center officials. He also discovered the second track while clearing and excavating the stone plate that contained the first print. Nodosaurs are a type of heavily-armored plant eater, as heavy as small elephants. The name is derived from the many spikes or nodes in their armor.

“It looks to be a manus print of a much smaller dinosaur than the first one, but it looks to be the same type,” Weems said of the second track. The manus is the front foot of a quadrupedal animal, while the pes is the back foot. “If the one that came through was a female, it may have had one or more young ones following along. If you’ve seen a dog or cat walking with its young, they kind of sniff around and may not go in the same direction (as the adult), but they end up in the same place.” On Friday, Aug. 17, 2012, noted dinosaur hunter Ray Stanford shared the location of that footprint with Goddard’s facility management.

“This was a large, armored dinosaur,” Stanford said. “Think of it as a four-footed tank. It was quite heavy, there’s a quite a ridge or push-up here. Subsequently, the sand was bound together by iron-oxide or hematite, so it gave us a nice preservation, almost like concrete.”

Stanford, a “proud amateur dinosaur tracker” has had several papers published, including the discovery of a new species of nodosaur from a fossilized hatchling found near the University of Maryland in College Park. He previously confirmed the authenticity of this track with David Weishampel of Johns Hopkins University in Baltimore, author of the book “Dinosaurs of the East Coast.”

The tracks had to have been made around the same time, at least within the same day, said Stanford, who discovered the “momma” track during the summer of 2012. The smaller track shows signs of pushing up the still-wet mud, which the larger footprint had hollowed out.

NASA Goddard facilities director Alan Binstock said the next steps will be to have the site analyzed to determine whether further excavation is called for, and to extract and preserve the existing footprints.

Stanford had material from the same Cretaceous-era sedimentary rock dated, with help from the U.S. Geological Survey, to approximately 110- to 112-million years old, by analyzing pollen grains sealed in the stone. The Cretaceous Period ran between 145.5 and 65.5 million years ago, and was the last period of the Mesozoic Era.

The footprint is on federal land, so improperly removing it could potentially violate three laws: the Antiquities Act, the Archaeological Resources Protection Act and the Paleontological Resources Preservation Act. NASA officials will next consult with the State of Maryland and paleontologists to form a plan for documenting and preserving the find, Binstock said.

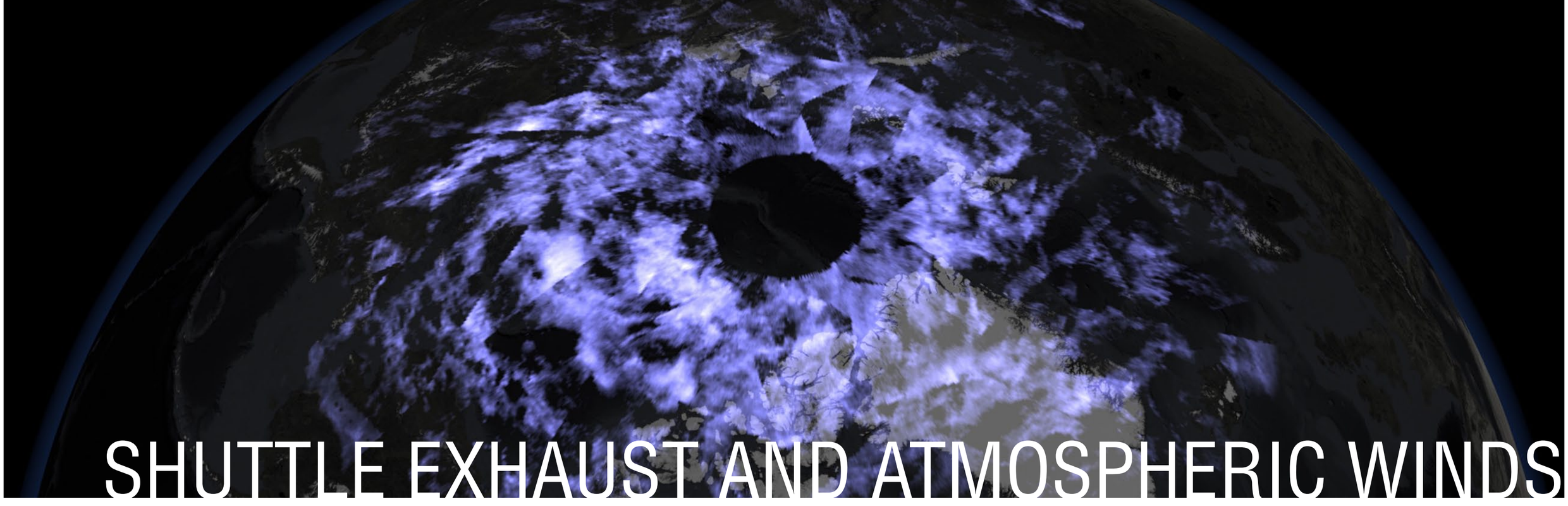
Stanford also identified and presented several smaller footprints—three-toed, flesh-eating therapods—to Goddard officials from the same site.

He called the location of the find “poetic.”

“Space scientists may walk along here, and they’re walking exactly where this big, bungling heavy armored dinosaur walked, maybe 110 to 112-million years ago,” Stanford said. ■

Above Dinosaur tracker Ray Stanford (L) brushes the cretaceous-era nodosaur track he found on the Goddard campus with Dr. Robert Weems, emeritus paleontologist for the USGS who verified his discovery. Credit: NASA/Goddard/Rebecca Roth

Opposite: This imprint shows the right rear foot of a nodosaur—a low-slung, spiny leaf-eater—apparently moving in haste as the heel did not fully settle in the cretaceous mud, according to dinosaur tracker Ray Stanford. Credit: NASA/Goddard/Rebecca Roth



SHUTTLE EXHAUST AND ATMOSPHERIC WINDS

By: Karen C. Fox

On July 8, 2011 the Space Shuttle Atlantis launched for the very last time. On that historic day, as the world watched its last ascent up into orbit and commentators discussed the program's contributions to space flight and scientific research over 20 years, the shuttle helped spawn one last experiment. As the shuttle reached a height of about 70 miles over the east coast of the U.S., it released – as it always did shortly after launch—350 tons of water vapor exhaust.

As the plume of vapor spread and floated on air currents high in Earth's atmosphere, it crossed through the observation paths of seven separate sets of instruments. A group of scientists, reporting in online in the *Journal of Geophysical Research* on August 27, 2012, tracked the plume to learn more about the airflow in the Mesosphere and Lower Thermosphere (MLT)—a region that is typically quite hard to study. The team found the water vapor spread much faster than expected and that within 21 hours much of it collected near the arctic where it formed unusually bright high altitude clouds of a kind known as polar mesospheric clouds (PMCs). Such information will help improve global circulation models of air movement in the upper atmosphere, and also help with ongoing studies of PMCs.

"Polar mesospheric clouds are the highest clouds on Earth," says space scientist Michael Stevens at the Naval Research Laboratory, Washington, who is first author on the paper. "They shine brightly when the sun is just below the horizon and typically occur over polar regions in the summer. There is some evidence that they are increasing in number and people want to know if this is indicative of climate change or something else that we don't understand."

Since they shine at night, PMCs are also known as noctilucent clouds, and they can serve as an indicator not just of temperature changes, but also of how currents and waves move high in Earth's atmosphere. A visible cloud of water vapor from something like the shuttle also offers a serendipitous way to observe such motions in the upper winds.

"The plume from the shuttle becomes a ready-made experiment to observe the movement in the atmosphere," says Charles Jackman, a scientist at Goddard who is the project scientist Aeronomy Ice in the Mesosphere (AIM) that specifically observes PMCs. "What this team found is interesting since the plume moved so quickly to the pole, indicating that the winds appear much stronger at those latitudes than was thought."

To track the plume across the sky, the scientists collated seven sets of observations, including data from AIM. The first two sets of instruments to see the plume were on TIMED (Thermosphere Ionosphere Mesosphere Energetics and Dynamics). Next the plume was viewed through the Sub-Millimeter Radiometer on the Swedish Odin satellite. When the plume reached higher latitudes, it was picked up by the ground-based Microwave Spectrometer at the Institute of Atmospheric Physics in Kühlungsborn, Germany as well as an identical ground-based water vapor instrument called cWASPAM1 at the Arctic Lidar Observatory for Middle Atmospheric Research (ALOMAR) in Andenes, Norway. The plume collated into its final shape over the arctic, as a new, extremely bright PMC on July 9, 2011 and there, it could be observed from above by the AIM satellite flying overhead, and from below by another instrument at ALOMAR called the RMR lidar.

Over the course of the plume's travels, these observations showed it spreading horizontally over a distance of some 2000 to 2500 miles. Those parts that drifted into the high latitudes near the North Pole formed ice particles which settled into layers of PMCs down at about 55 miles above Earth's surface. The speed with which the plume arrived at the arctic was a surprise.

> "...people want to know if this is indicative of climate change or something else that we don't understand."

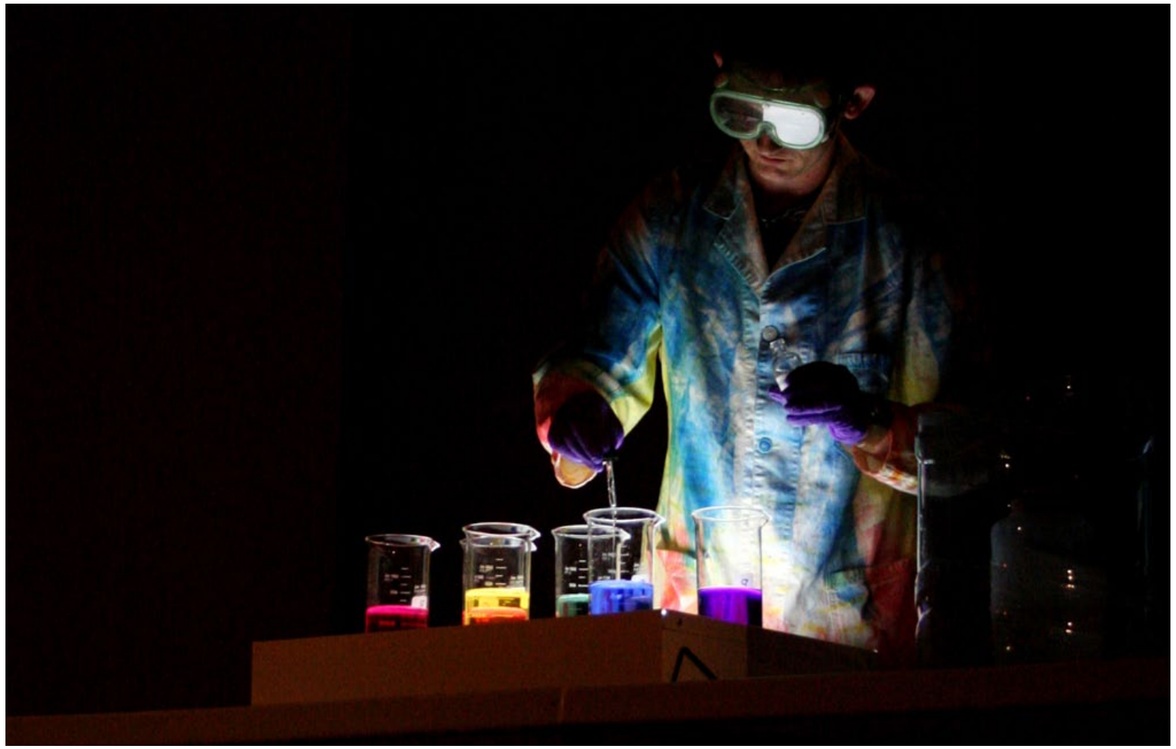
"The speed of the movement in the upper atmosphere gives us new information for our models," says Stevens. "As you get higher up in the atmosphere, we just don't have as many measurements of wind speeds or temperatures. The take-away message here is that we need to improve the models of that region."

Since observations of PMCs may be connected to global climate, it's important to subtract out sporadic effects such as shuttle exhaust from other consistent, long-term effects.

"One of AIM's big goals is to find out how much of the cloud's behavior is naturally induced versus man-made," says Jackman. "This last shuttle launch will help researchers separate the shuttle exhaust from the rest of the observations."

Indeed, the AIM observations showed a clear difference between typical PMCs and this shuttle-made one. Normally smaller particles exist at the top, with larger ones at the bottom. The shuttle plume PMC showed a reversed configuration, with larger particles at the top and smaller at the bottom – offering a way to separate out such clouds in the historical record. ■

Above: NASA's Aeronomy In the Mesosphere (AIM) mission captures images like this of shining noctilucent clouds, also known as polar mesospheric clouds (PMCs), which hover over Earth's poles in summertime. Credit: NASA/AIM



On July 23, nearly 300 students from 72 countries on every continent but Antarctica took a trip to Goddard as part of the 44th International Chemistry Olympiad (IChO). The IChO is an annual competition for secondary students who have shown talent and promise in chemistry. Founded in 1968, the competition is hosted in a different participating country every year. This is the second time it has been held in the United States.

The 2012 IChO spanned ten days in July, including excursions, cultural experiences, and a rigorous two-day exam that tested the students' understanding of complex chemistry concepts and laboratory skills.

Nobel laureate Dr. John Mather presented to the students on the history of the universe, exploring the beginnings of chemistry in distant stars. "Every time you look in the mirror in the morning, you're looking at the insides of exploded stars," he said. Many of the elements and compounds we are familiar with today originated in long-gone galaxies.

Mather showed the students a bronze copy of his Nobel Prize and asked them how to tell the difference between the bronze copy and the gold original. After a few seconds of guessing, he revealed that the key was the weight: gold has a higher density than bronze, so the bronze copy weighs less.

Astronaut Dr. Piers Sellers, the Deputy Director of Sciences and Exploration at Goddard, opened his presentation with a question: "Anybody here like to go into space?" Sellers talked about astronaut training, the Space Shuttle, and launch using a toy shuttle with detachable fuel tank and rocket boosters to illustrate the launch sequence.

When a student asked how astronauts go to the bathroom in space, Sellers laughed. "Everyone always asks that question," he said. His answer: very carefully.

The event closed with a chemistry demonstration show by NASA postdoctoral researcher Dr. Joshua Sebree, who took the stage in a tie-dyed lab coat and safety goggles to perform a series of experiments that he warned should not be tried unsupervised.

For his final demonstration, Sebree and two assistants mixed salt solutions in beakers and set them on fire creating an array of multicolored flames. The students easily guessed which chemicals were responsible for each one, but the green flame stumped them; Sebree had substituted the traditional copper for boric acid, which burns brighter.

The program concluded with an American picnic-style lunch at the Recreation Center. ■

Above: Dr. Joshua Sebree prepares colorful salt solutions for his final demonstration. Photo credit: NASA/Goddard/Becky Strauss

CHEMISTRY STUDENTS FROM AROUND THE WORLD GATHER AT GODDARD

By: Becky Strauss

RESEARCH ON THE FLY

By: Elizabeth M. Jarrell

Top: NASA research pilots Rich Rogers (right) and Joe Mollahan flying at 500 feet over the Alaska north slope tundra during June 2012 Carve mission.

Middle: Photo from the cockpit during a research flight at 500 feet just south of the Brooks Mountain range in northern Alaska.

Above: A tundra fire on the North Slope of Alaska's Brooks Mountain Range.

Photos provided by Rich Rogers

NASA research pilot Rich Rogers flies low, cool, slow, and true; especially while flying science missions over remote and sometimes very cold areas of our planet. Rogers, a U.S. Naval Academy graduate and retired Navy commander who flew combat patrol aircraft, now flies scientists and their instruments in the same type of patrol aircraft he flew in the military. Instead of looking for submarines, terrorists, or drug runners, he now helps scientists obtain and verify their airborne science research data.

"We do the research version of bush pilot flying. We take off and land in remote areas and fly over tundra, river beds, glaciers, volcanoes, mountains, remote oceans, and even wildfires," Rogers explains. "Everything is planned."

"Flying is a lot of fun, just like playing a video game, but we have to really know our video game or flight technology and flight environment well. It is precision flying of science flight lines," says Rogers. He still has to continuously watch the landscape, look for other small aircraft and helicopters, and monitor the weather. "So we fly low and slow on a majority of our airborne science research flights," says Rogers.

Research flying for NASA is incredibly precise since the accuracy of the scientific data depends on the accuracy of the flight. "When we are calibrating instruments or under flying a satellite's track, the margin of error is sometimes only a couple of inches," he explains.

Most small aircraft fly at 2,000 to 10,000 feet. "We recently flew at 500 feet above the ground over most of Alaska which is only seconds away from hitting the surface," says Rogers. "You can never relax mentally or physically, you must be completely focused," he says. "But the views are spectacular."

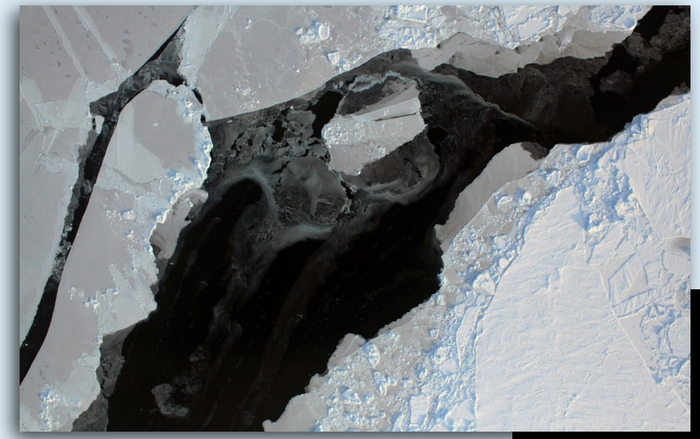
Even gas stops are challenging. The small plane has a 4 ½ hour gas tank which has to get them to one or only two gas stations both of which are three hours from their base and separated by a mountain range.

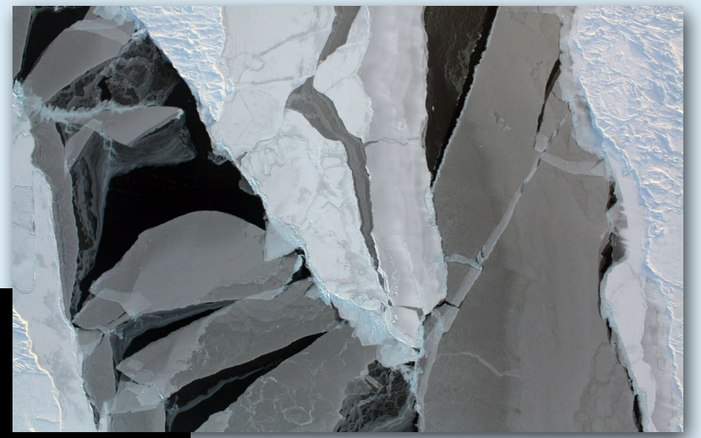
Rogers also takes great care in preparing for a camping trip he never hopes to take. The aircraft carries survival bags for everyone including Arctic-rated clothing.

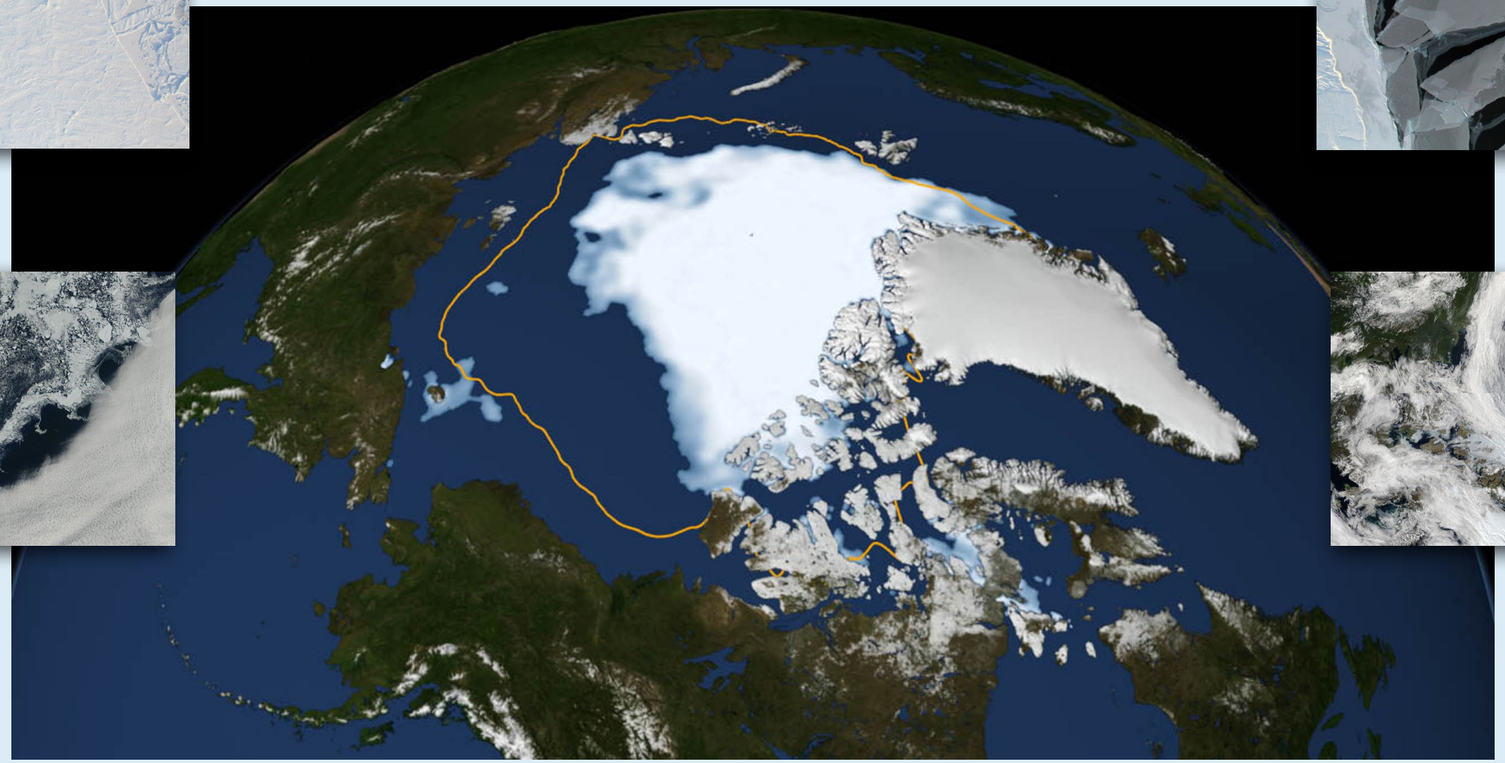
"When I am not flying our NASA research aircraft, I still thoroughly map out our family vacations," says Rogers. "I never have to stop to ask for directions! Adventure and discovery are always just ahead!" ■

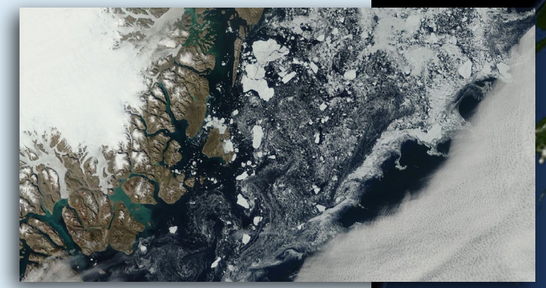
ARCTIC SEA ICE SHRINKS TO NEW LOW IN SATELLITE ERA

By: Maria-José Viñas









The extent of the sea ice covering the Arctic Ocean has shrunk. According to scientists from NASA and the NASA-supported National Snow and Ice Data Center (NSIDC) in Boulder, Colo., the amount is the smallest size ever observed in the three decades since consistent satellite observations of the polar cap began.

The extent of Arctic sea ice on Aug. 26, as measured by the Special Sensor Microwave/Imager on the U.S. Defense Meteorological Satellite Program spacecraft and analyzed by NASA and NSIDC scientists, was 1.58 million square miles (4.1 million square kilometers), or 27,000 square miles (70,000 square kilometers) below the Sept. 18, 2007 daily extent of 1.61 million square miles (4.17 million square kilometers).

The sea ice cap naturally grows during the cold Arctic winters and shrinks when temperatures climb in the spring and summer. But over the last three decades, satellites have observed a 13 percent decline per decade in the minimum summertime extent of the sea ice. The thickness of the sea ice cover also continues to decline.

"The persistent loss of perennial ice cover ~~ice~~ that survives the melt season ~~led~~ to this year's record summertime retreat," said Joey Comiso, senior research scientist at Goddard. "Unlike 2007, temperatures were not unusually warm in the Arctic this summer."

The new record was reached before the end of the melt season in the Arctic, which usually takes place in mid- to late-September. Scientists expect to see an even larger loss of sea ice in the coming weeks.

"In 2007, it was actually much warmer," Comiso said. "We are losing the thick component of the ice cover. And if you lose the thick component of the ice cover, the ice in the summer becomes very vulnerable."

"By itself it's just a number, and occasionally records are going to get set," NSIDC research scientist Walt Meier said about the new record. "But in the context of what's happened in the last several years and throughout the satellite record, it's an indication that the Arctic sea ice cover is fundamentally changing." ■

Main image: The extent of Arctic sea ice on Aug. 26, 2012, the day the sea ice dipped to its smallest extent ever recorded in more than three decades of satellite measurements, according to scientists from NASA and the National Snow and Ice Data Center. Image credit: NASA

Surrounding photos: Varying thicknesses of sea ice are shown, from thin, nearly transparent layers to thicker, older sea ice covered with snow. Ice swirls and a summer storm in Greenland. Photo credit: NASA

OUTSIDE GODDARD

By: Elizabeth M. Jarrell

NOT JUST ANOTHER NERDY ROCK BAND

Although he never took a music lesson, engineer and drummer Joe Easley recently returned from a weeklong reunion tour of Japan with his indie rock band "Dismemberment Plan."

"Pretty much you don't have to take lessons to be in a rock band," Easley says. "The reason each band sounds a little different is because they taught themselves and you're hearing their mistakes." None of them read or write music either, he says. "This is a rock band. We just remember our parts."

The band's name comes from the movie "Groundhog Day," in which a character stuck in an infinite time loop buys an accidental death and dismemberment plan. "Despite the name we're not an angry band," Easley says. "We're a bunch of nerds basically. A lot of people have stereotypes about people in rock bands. … One of our members does not even drink. None of us smoke or do drugs."

In addition to Easley, the band has a bass player, a guitar player and a singer. Other than Easley, the musicians also switch off playing the keyboard.

"Everyone's got a day job," Easley says. He joined the group in 1996, took a leave from college, and went on a month-long tour of the East Coast. "We bought a 15-passenger Ford van, threw in all our gear, and jumped in."

"We played over 800 shows over the years," he says. "It's a huge blur now." As the band became more established, they bought a better van, hired a crew and even stayed in hotels. "Touring got much easier at that point."

The band toured on and off until 2003. During that time, they played in 47 states, Japan and numerous countries across Eastern and Western Europe.

Easley says he considers the band's 1999 album "Emergency & I" to be their most notable. It was recently rereleased on vinyl and was the basis for their reunion tour. "The album title is something our singer came up with, which I always thought referred to how you feel when you are in your 20s and everything seems like emergency," he says.

Their reunion tour schedule was frenetic and even included an appearance on "Late Night with Jimmy Fallon." "We played 10 shows each weekend for two months. Then we went to Japan for a weeklong tour," Easley says. The band also played shows in New York City, Boston, Philadelphia, Washington, D.C., Chicago and Seattle.

"Going to Japan is like going on a really great vacation and getting paid a little bit," he says. He only brought his snare drum and cymbals due to the logistics of shipping a full drum set.

But don't count on any future tours, Easley says. "There is only so much touring you can do on an old record and I'd be pretty surprised if we made a new one," he says. "We're all in established jobs and starting families."

Their audience is growing older along with them, Easley says: Half the current audience is in their late 30s, just like the band members, but they're also attracting 20-somethings too. "Our shows are bigger than before and most are all sold out," he says. Their reunion tour crowds have ranged from a few hundred to 1,500. Their biggest crowd ever was back in the day when they opened for Pearl Jam to an audience of 12,000.

Easley says he doesn't feel like a rock star. "We attract the type of people who are interested in reading the lyrics to learn the story," he says. "We don't have girls in our dressing rooms. Both of my parents came to our last D.C. show and they approved—especially that we sold a lot of tickets in a decent-sized venue."

Easley will always play the drums. "Playing drums is super therapeutic especially after a stressful day at work," he says. "It's very satisfying." Easley says he has no plans to be in another rock band. "I've got a nice lady and a nice two-year-old kid," he says. "Even though Japan was a great tour, I really missed them."

"I already got my son a drum set. I think he thinks he might be playing them. He definitely likes hitting them." ■

Below: Easley on the drums. Photo credit: Taku Tatewaki
The band on stage during a tour. Photo credit: Heidi Easley